

Appl. No. : 10/609,015
Filed : June 27, 2003

REMARKS

Claims 1, 5, 6, 8-15, 25-29, and 31-33 are pending in this application. Claims 1, 31, and 32 have been amended. Claims 2-4 and 30 have been canceled. Support for the amendments and is found in the specification and claims as filed.

Claim Rejections - 35 U.S.C. § 103(a)

Claims 1-6, 8-13, and 25-33 have been rejected under 35 U.S.C. §102(e) as obvious over U.S. Publication No. US 2003/0160026 A1 (hereinafter “Klein *et al.*”), in view of U.S. 6,594,542 (hereinafter “Williams”), and further in view of U.S. 2002/016221 A1 (hereinafter “Skorupshi *et al.*”). To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. *See, e.g.*, M.P.E.P. § 2142. There is no such suggestion in any of the cited references to combine or modify the references so as to produce the claimed invention.

Pending independent Claim 1 as amended recites a method of etching a semiconductor substrate, the method comprising, *inter alia*, a step of “applying a caustic etching paste comprising an etchant and a thickener to a part or a layer of the substrate, wherein the semiconductor substrate is selected from the group consisting of a microcrystalline silicon substrate, a polycrystalline silicon substrate, an amorphous silicon substrate, a doped silicon substrate, a gallium arsenide substrate, a gallium arsenide phosphide substrate, a germanium substrate, and a silicon germanium substrate, and wherein the etchant is a water-based etchant selected from the group consisting of potassium hydroxide, sodium hydroxide, ammonium hydroxide, combinations thereof, and derivatives thereof.”

Skorupshi *et al.* discloses aqueous alkaline etching solutions (e.g., of sodium hydroxide, potassium hydroxide, ammonium hydroxide as in paragraph [0022]). Skorupshi *et al.* does not disclose etching pastes, or the use of thickeners in connection with the disclosed caustic etchants. Williams includes no teaching of any particular etching media. Williams only discloses an apparatus for chemical mechanical polishing of selected materials, e.g., monocrystalline silicon. As mentioned in Applicants’ response to the previous Office Action, Klein *et al.* only discloses fluoride containing etchants. Klein *et al.* does not disclose use of an etchant such as potassium

hydroxide, sodium hydroxide, or ammonium hydroxide. Moreover, there is no teaching, suggestion, or motivation to substitute ammonium hydroxide or any of the other recited etchants for the ammonium (bi)fluoride etchants of Klein *et al.* In the Office Action it is stated that “since Klein discloses that the etchant contains ammonium, one skilled in the art at the time the invention was made would have found it obvious to employ an etchant such as ammonium hydroxide in Klein method ...” This is a mischaracterization of the teachings of Klein *et al.*, in that Klein *et al.* discloses fluoride-containing components of an etching paste, such as ammonium fluoride and ammonium bifluoride (see paragraph [0055] of Klein *et al.*). The term “ammonium” is used to refer to the ammonium ion (NH_4^+ - the weak conjugate acid of ammonia (NH_3) - a strong base). The Office Action ignores the identity of the counter ion in the etchants of Klein *et al.*, namely, the fluoride ion (F^-). Ammonium fluoride or ammonium bifluoride, when dissolved in water, generate hydrogen fluoride (HF - a strong acid) to yield an acidic solution.

The Office Action proposes replacing ammonium fluoride (NH_4F) or ammonium bifluoride (NH_4HF_2), which generate acidic solutions when mixed with water, with ammonium hydroxide (NH_4OH) - a strong base containing no fluoride ion. If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). Substituting a strong base etchant for an acidic fluoride-containing etchant clearly changes the principle of operation of the etching media of Klein *et al.* Further evidence for the unsuitability of the proposed substitution can be found by examining the other optional components of the Klein *et al.* etching media, namely an organic or inorganic acid. Klein *et al.* states that “inorganic mineral acids, such as, for example, hydrochloric acid, phosphoric acid, sulfuric acid and nitric acid, and also organic acids which have an alkyl radical chain length of $n=1-10$ improve the etching action of the printable, homogeneous, particle-free etching pastes having non-Newtonian flow behaviour.” (See paragraph [0080]). Such acids may be compatible with the fluoride-containing etchants disclosed in Klein *et al.*, and even enhance their performance, but would be incompatible or even hazardous when mixed with a strongly basic ammonium hydroxide etchant (or potassium hydroxide or sodium hydroxide etchant), because the acid would react with and neutralize the

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basic etchant, thereby destroying its etching ability. If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Accordingly, Klein *et al.*, alone or in combination with Skorupshi *et al.* or Williams, cannot render obvious Claims 1-6, 8-13, and 25-33. Accordingly, Applicants respectfully request that the rejection be withdrawn.

Claim Rejection - 35 U.S.C. §103(a)

Claims 14-15 have been rejected under 35 U.S.C. §103(a) as obvious over Klein *et al.* in view of Williams and Skorupshi *et al.*, and further in view of US 6,524,880 ("Moon *et al.*"). To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. *See, e.g.*, M.P.E.P. § 2142. As discussed above, there is no such suggestion in any of the cited references to combine or modify the references so as to produce the claimed invention.

As discussed above, Klein *et al.*, alone or in combination with Skorupshi *et al.* or Williams, does not render obvious pending independent Claim 1, from which Claims 14-15 depend. Moon *et al.* does not overcome the deficiencies of Klein *et al.*, Skorupshi *et al.*, and Williams. Moon *et al.* relates to a method for wet-etching glass, namely, phosphosilicate glass, borosilicate glass, and boronsilicate glass, in a method for fabricating a solar cell; however, no details regarding the wet etch of the substrate are provided. The only etching solution disclosed is an acidic HF solution for etching the phosphosilicate glass or borosilicate glass. No teaching or suggestion of the use of either a caustic etching paste or a thickener is provided in Moon *et al.* Because Moon *et al.* does not overcome the deficiencies of Kline *et al.*, Skorupshi *et al.* or Williams, the combination of these references with Moon *et al.* cannot render Claims 14-15 obvious. Accordingly, Applicants respectfully request that the rejection be withdrawn.

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Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns that might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number below.

Respectfully submitted,

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AMEND

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